National Aeronautics and Space Administration

AFTA SDT
2nd Meeting
Long Beach, CA

January 10, 2012

Astrophysics

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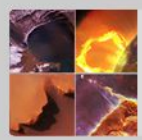
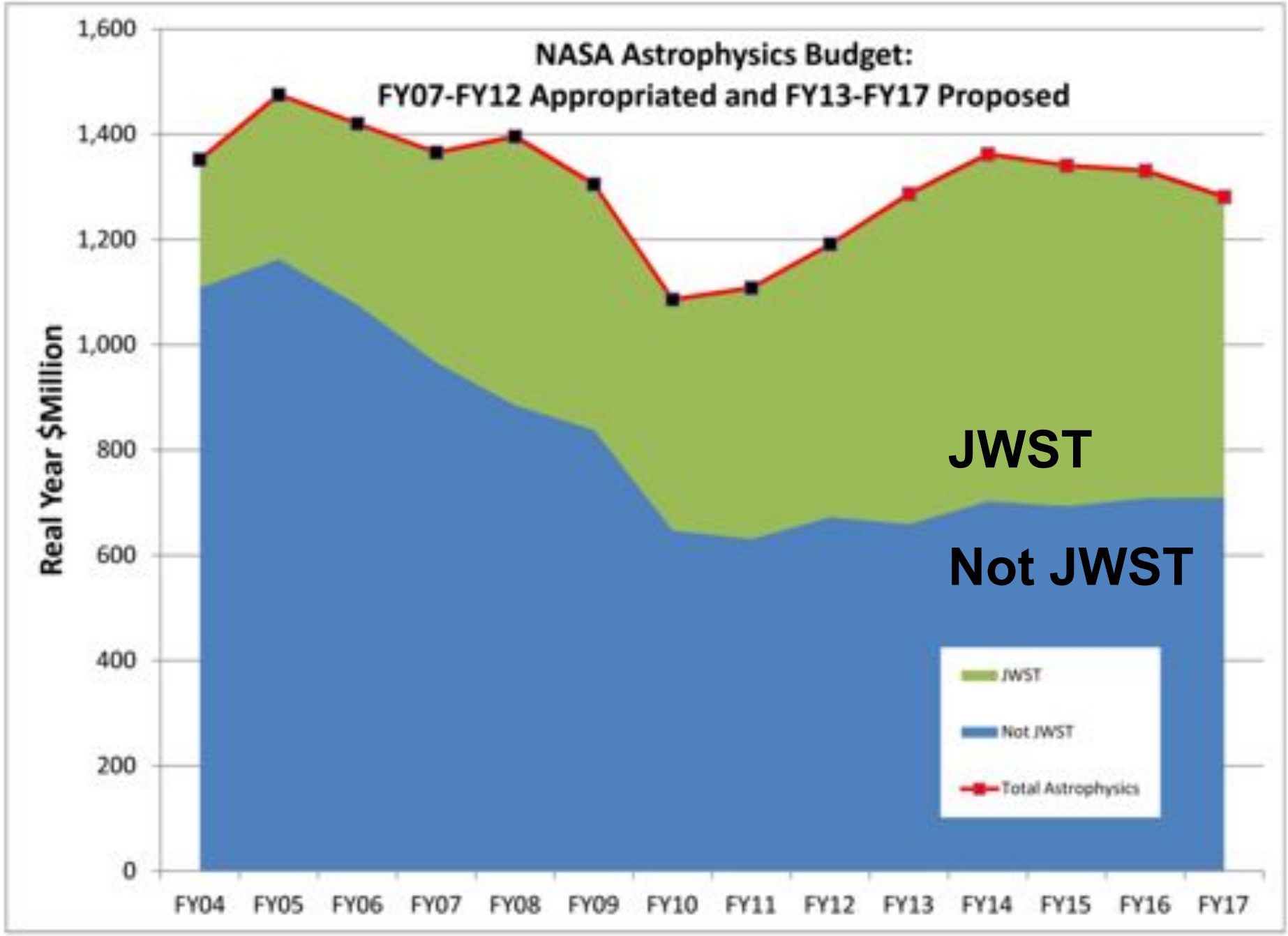
www.nasa.gov



The Big Picture…..

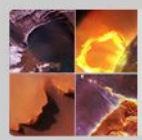
- **This is a time of opportunity for NASA Astrophysics**
  - The total Astrophysics budget is at a high level.
  - Large and small space-based observatories spanning the electromagnetic spectrum are currently studying the universe.
  - The James Webb Space Telescope, the highest priority of the community, is on schedule for an October 2018 launch.
  - Astounding suborbital-class investigations are being conducted on sounding rockets, balloons, and the International Space Station.
  - Individual investigators are leading data analysis, theory, and technology development projects selected through open, competitive, peer reviewed solicitations.
  - We are preparing for the strategic mission that will be developed following JWST.

- **The budgetary future is uncertain**
  - “If you can’t live with uncertainty, please don’t come to work at NASA Headquarters.” (Paul Hertz, quoted in Space News, 2012 Nov 11 issue)


NASA Astrophysics Budget:
FY07-FY12 Appropriated and FY13-FY17 Proposed
Real Year $Million
1,600
1,400
1,200
1,000
800
600
400
200
0
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
JWST
Not JWST
JWST
Not JWST
Total Astrophysics

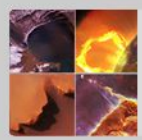
Astrophysics Budget Reality

- **There is inadequate available budget to implement the Astro2010 Decadal Survey recommendations as written; there is also changed external context.**
  - JWST was rebaselined for a 2018 launch with an increased cost commitment LCC of $8.8B, an increase of $3.1B.
  - Although the total funding for astrophysics is higher than the Decadal Survey assumed, the increased cost of JWST has left insufficient funding over the decade to address the Decadal Survey recommendations for new projects and activities.
  - Due to budget constraints, no new astrophysics missions other than Explorers can enter formulation before FY17, when JWST approaches launch.
  - NASA and ESA have ended the joint LISA and IXO studies.
  - NASA has committed to a partnership with ESA on Euclid.
  - NASA is considering whether the NRO 2.4m telescope assets can enable astrophysics priorities or other NASA objectives.
- **Large strategic missions in the future are possible only with the Astrophysics budget that is freed up as JWST spending begins to decrease in FY17 and out.**
  - A new strategic mission can be started as early as FY17 subject to available funding.



Astrophysics Near-term Goal and Strategy

- **The goal is to be prepared to start a new strategic Astrophysics mission to follow JWST as soon as funding becomes available while continuing to advance the science during the interim.**
  - It cannot be assumed that the authority to start a new large mission (i.e., WFIRST) will be granted in 2017, therefore concepts for moderate cost missions, probes that cost no more than approximately $1B, must also be considered.
  - Any mission concept studied must derive from the science objectives of the Decadal Survey's prioritized activities.
- **The strategy is to use the science and prioritized activities of the Astro2010 Decadal Survey to guide strategy and inform choices.**
  - In the absence of new missions, progress against decadal priorities is maintained through the core research program, through continued operation of existing missions and their GO programs, through the suborbital programs, and through frequent Explorer opportunities.
- **In order to prepare for a new strategic mission**
  - A near term program of mission concept studies and technology development will be undertaken
  - These studies will inform a mid-decade decision on which mission will begin formulation starting as early as FY17.



Preparing for the Next Strategic Mission

Strategic Mission Concepts	Derived from Recommendation	Status of Studies	Plan for Future
WFIRST: Large Strategic Mission (DRM1)	Large 1st : WFIRST	Completed in 2012	Candidate large mission for mid-decade
WFIRST: Probe-size Strategic Mission (DRM2)	Large 1st : WFIRST	Completed in 2012	Candidate probe for mid-decade
Use of the 2.4m telescope assets to advance the science of WFIRST (study includes an optional second instrument to advance exoplanet science)	Large 1st : WFIRST (Medium 1: New Worlds Technology)	Started in 2012	Candidate large mission for mid-decade
Gravitational Wave missions to advance the science of LISA	Large 3rd : LISA	Completed in 2012	Candidate large mission for next decade; candidate for international partnership
X-ray missions to advance the science of IXO	Large 4th : IXO	Completed in 2012; under consideration for study in 2014	Candidate probe for mid-decade; candidate large mission for next decade; candidate for international partnership
Exoplanet probes to advance the science of a planet characterization and imaging mission	Medium 1st : New Worlds Technology	Planned for 2013	Candidate probe for mid-decade; candidate large mission for next decade
Cosmic Microwave Background Polarization Probe	Medium 2nd : Inflation Probe Technology	Study under consideration for study in 2015	Candidate probe or large mission for next decade
Science and technology drivers for a UV/Visible mission	Small: (Definition of) a future UV-optical space capability	Started in 2012	Candidate probe or large mission for next decade

Program Update – WFIRST

- **WFIRST Science Definition Team (SDT) delivered its final report in August 2012**
  - First Design Reference Mission (DRM1) is a proof of concept that a mission can be constructed that is compliant with the Astro2010 recommendation. [1.3m mirror, current technology detectors, 5 year mission]
  - Second Design Reference Mission (DRM2) does not duplicate capabilities of Euclid, LSST, and JWST in advancing science objectives of WFIRST and looks for cost savings. [1.1 m mirror, evolved technology detectors, 3 year mission]
  - SDT report shows that (a) DRM1 is fully responsive to the objectives of Astro2010 and (b) DRM2 offers a low-cost near-IR survey opportunity, but the limited 3-year life precludes full compliance with Astro2010 goals.
- **Astrophysics Focused Telescope Assets (AFTA) SDT studying use of 2.4m telescope assets for advancing the science objectives of WFIRST**
  - See next slide
- **WFIRST Study Office at GSFC is continuing to revise DRM and study trades**
- **NASA is investing in evolved detector technology through the competitive SAT program**
  - Enable the continued maturation of the H4RG-10 near-IR detector array to TRL-5
  - Achieve HgCdTe detector design/process improvements that will benefit WFIRST and other applications

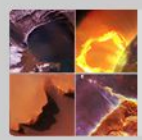
http://wfirst.gsfc.nasa.gov/

Astrophysics Focused Telescope Assets (AFTA) Study

- **In June 2012, NASA announced that it had acquired the use of two sets of 2.4m space-qualified telescope optics systems and supporting components.**
- **A seven month study is underway to assess the use of the 2.4m telescope assets for a mission that can accomplish the WFIRST science.**
  - Study started in October 2012 and will be completed by May 2013.
  - Schedule and cost estimate to be developed and completed by May 2013.
- **Science Definition Team (SDT) formed to support study activities at GSFC and develop a Design Reference Mission (DRM).**
  - Co-Chairs, David Spergel (Princeton U.) and Neil Gehrels (GSFC).
- **SDT report, including DRM, due April 30, 2013.**
  - Study to include an option to add a coronagraph for exoplanet science as an example of a secondary
- **SDT report will inform NASA's decision on future use of the telescope assets**
- **WFIRST and AFTA Special Session on Tuesday 7:00 pm in Room 101A**

http://wfirst.gsfc.nasa.gov/science/

Mock up of the 2.4m telescope now located at GSFC

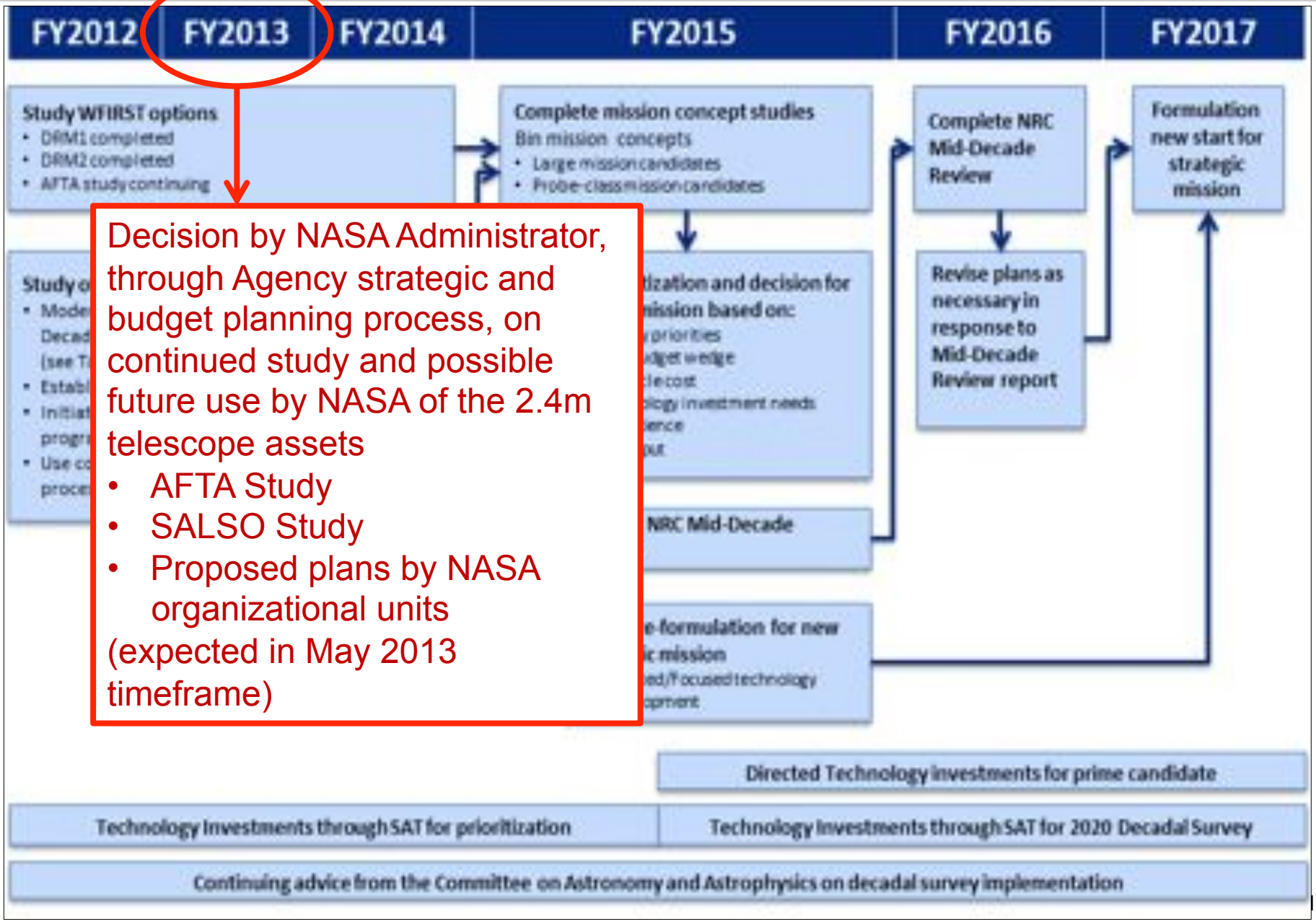


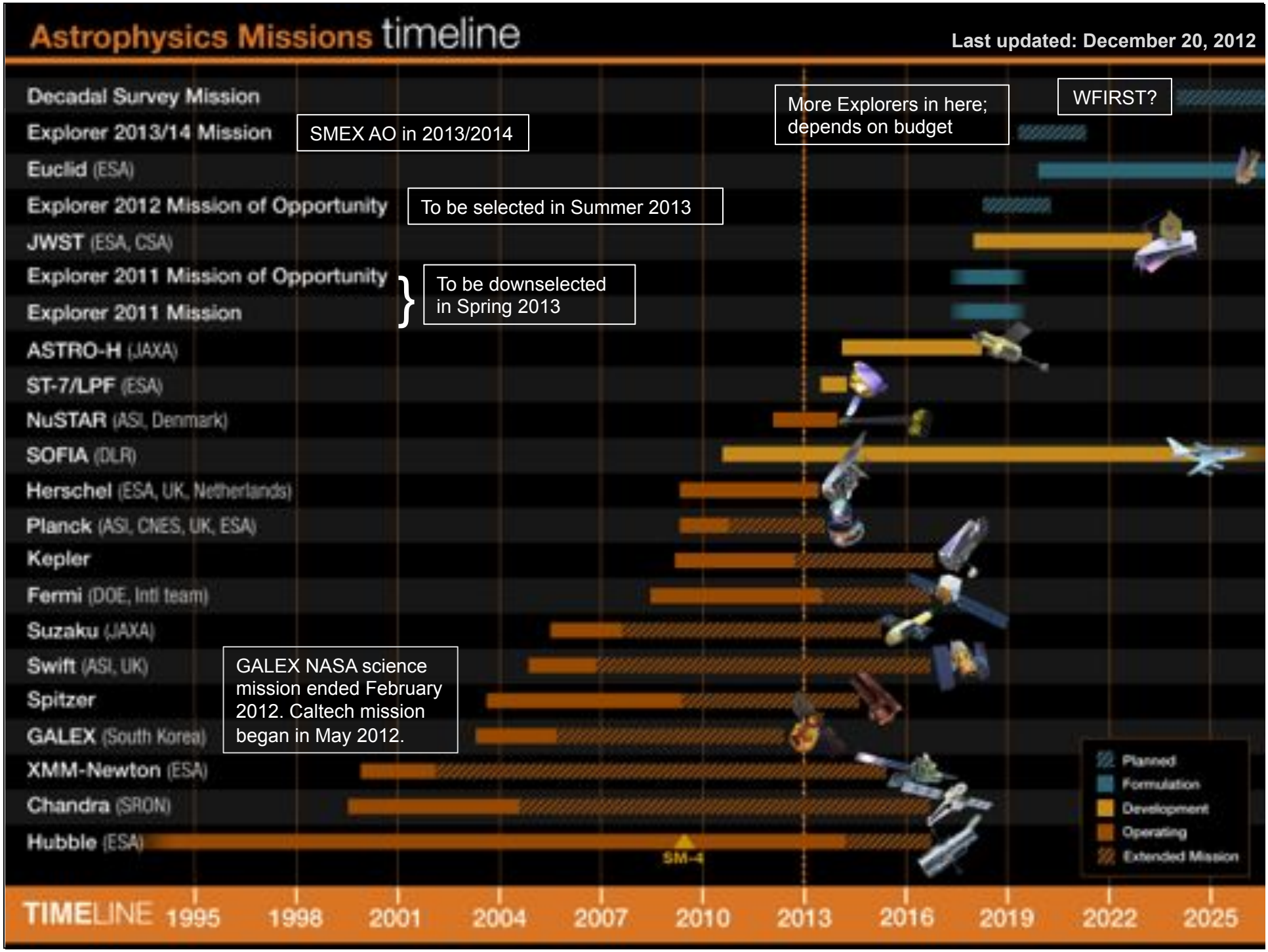
Study on Applications of Large Space Optics (SALSO)

- In June 2012, NASA announced that it had acquired the use of two sets of 2.4m space-qualified telescope optics systems and supporting components.
- Although their most obvious applications are in astrophysics, **NASA is interested in identifying possible uses for these systems to address a broader range of its science, exploration, and technology goals.**
  - In November 2012, NASA released an RFI soliciting broad community inputs focused on utilization of the telescope assets for Agency goals aligned with 5 principal areas: space technology, human exploration and operations, heliophysics, planetary science, and astrophysics (excluding a wide field infrared survey). (Responses were due January 7, 2013)
  - A workshop will be held February 5-6, 2013, in Huntsville AL to provide a forum for concept presentation and discussion of innovative ideas.
  - This will be followed by additional study by NASA of representative concepts presented at the workshop. Related presentations may be combined for use as input to this additional analysis.
- **NASA will use all of the information gathered to formulate and evaluate future strategies for utilizing the assets to advance Agency goals.**
  - A final study report will contain the workshop briefings and the results of follow-on analyses. This report will be completed about May 2013 and publicly released thereafter.

http://science.nasa.gov/salso/

Astrophysics Near-term Strategy




Astrophysics Missions timeline
Last updated: December 20, 2012
Decadal Survey Mission
Explorer 2013/14 Mission
SMEX AO in 2013/2014
Euclid (ESA)
Explorer 2012 Mission of Opportunity
To be selected in Summer 2013
JWST (ESA, CSA)
Explorer 2011 Mission of Opportunity
Explorer 2011 Mission
To be downselected in Spring 2013
ASTRO-H (JAXA)
ST-7/LPF (ESA)
NuSTAR (ASI, Denmark)
SOFIA (DLR)
Herschel (ESA, UK, Netherlands)
Planck (ASI, CNES, UK, ESA)
Kepler
Fermi (DOE, Intl team)
Suzaku (JAXA)
Swift (ASI, UK)
Spitzer
GALEX (South Korea)
GALEX NASA science mission ended February 2012. Caltech mission began in May 2012.
XMM-Newton (ESA)
Chandra (SRON)
Hubble (ESA)
SM-4
More Explorers in here; depends on budget
WFIRST?
Planned
Formulation
Development
Operating
Extended Mission
TIMELINE 1995 1998 2001 2004 2007 2010 2013 2016 2019 2022 2025